

**It is the lightweight software high-molecular actuator which was developed for the first time in the world.**

**As an electrode the gold is formed in the ion exchange resin with special chemical plating,**

**Displacement efficiency it is large by enlarging the electrode surface area very improvement**

**It could point, it is the actuator element of the composite material.**

**It moves quickly largely 2V due to voltage low.**

## Feature

1. It can control the movement electrically.

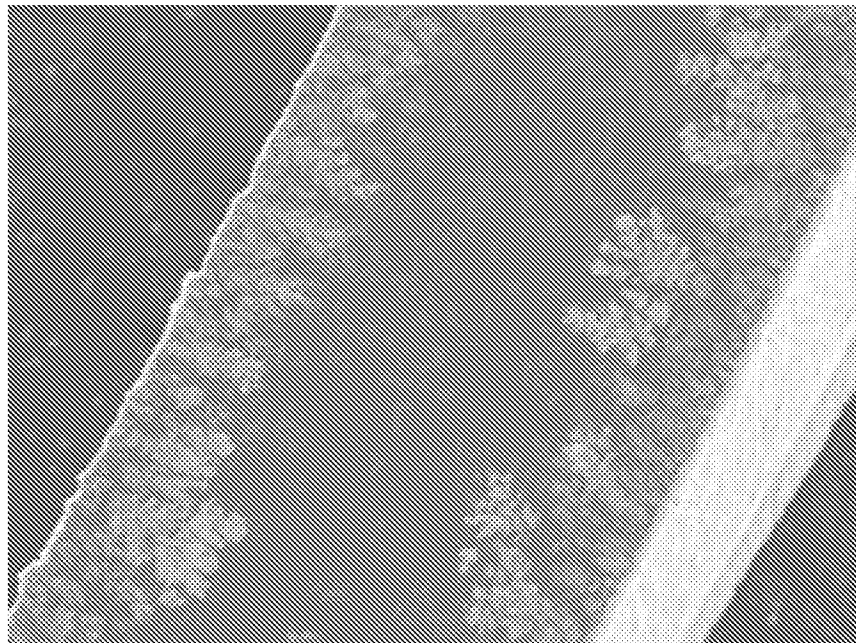
2. It is tenderness of the same rank as the muscle.

3. Because the structure is the resin, it is light.

4. When driving sound is not generated.

5. Occurrence power becomes large by enlarging size.

6. 0.1mm - Compilation of the drive device to 10mm is



Element membrane section photograph  
Element inside fractal electrode structure

possible.

7. The movement like the creature with the combination of the element is possible.

8. It is possible to move by electric power (0.05 - 0.2W) low.

9. Drive of the long period of time (1 year) is possible.

10 Medium underwater drive of the air is possible.

11. Because electromotive force occurs attendant upon the deformation of the element, itself functioning it does as a sensor.

Are not the present electric motor and the solenoid cylinder and the like, many we have the quality which is superior,

The design of the new device becomes possible.

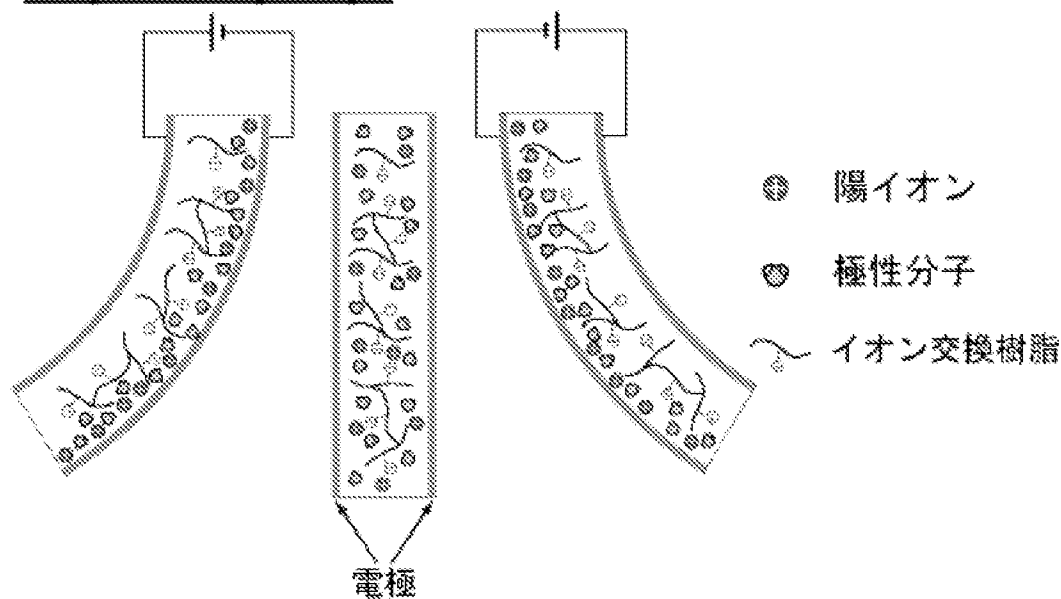
### **1. Basic operating characteristic**

The element does with the ion exchange resin, it is hardness of the muscle of the organism. It is soft, it damages and occurrence power differs largely depending upon the size and structure of the element. In addition, it changes response frequency with prudence length.

	<b><u>Tanzaku shape</u></b>			
(Mm)	0.2t×1×20	0.2t×1×5	0.5t×3×10	1t×3×10
Response frequency (Hz)	50	500	30	20
Displacement quantity (mm)	3 revolutions	1 revolution	1 revolution	1/2 revolutions
Displacement speed (mm/sec)	50	100	30	20
Occurrence power (g)	0.02	1.0	6.0	40

	<b><u>Doughnut shape</u></b>	
(Mm)	0.5t×10 φ	0.5t×30 φ
Response frequency (Hz)	30	30
Displacement quantity (mm)	0.5	0.5
Displacement speed (mm/sec)	0.5	1
Occurrence power (g)	20	70

## **2. Operational principle**



Response  
mechanism

Due to the impression of voltage, the cation inside high polymer electrolyte moves to cathode side,  
With the inside and outside difference occurring in swelling, it becomes deformed.

## **3. Operation design**

The ionic conduction actuator shows various displacement qualities by changing the condition at the time of the below-mentioned drive.

- Size of element

Occurrence power becomes large by enlarging thickness (Element thickness : occurrence power graph)

0.1mm - Production of the element of 10mm angular size is possible.

- Form of element

The movement changes with the form of form, and the formation item which are quarried out from the membrane.

Occurrence power is decided by rigidity (element length : occurrence power graph) and the support place which are decided from geometric form of the element

For the sake of, in case of multi point supports big power is generated.

In the tube condition element displacement of all directions becomes possible.

- Electric insulated groove

With the formation of the insulated groove, responds to the electric value of resistance to show the movement which, the various movement  
It can make.

- Connection of element

Changing polarity, the opposite movement you can obtain displacement direction by connecting.

- Type of ion

Because displacement speed, the displacement quantity differs with ion kind, it can select according to use.

- Control of operation

Displacement speed, the displacement quantity, position is controlled low by electric power.

- Applied voltage ripple mark

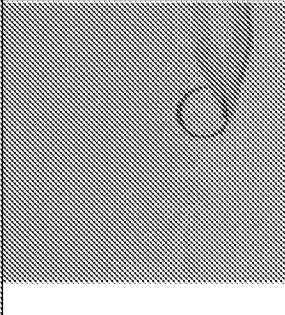
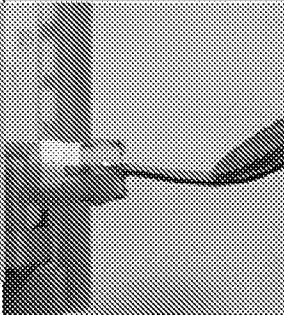
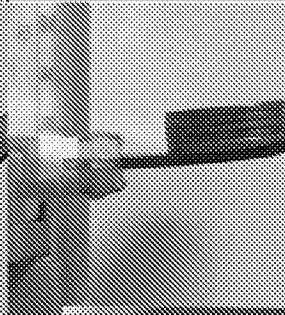
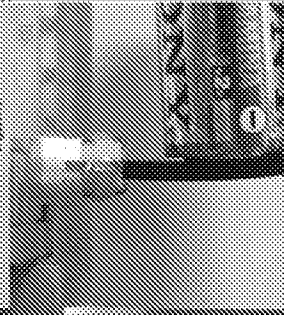
It can control the change speed inside 1 cycle.

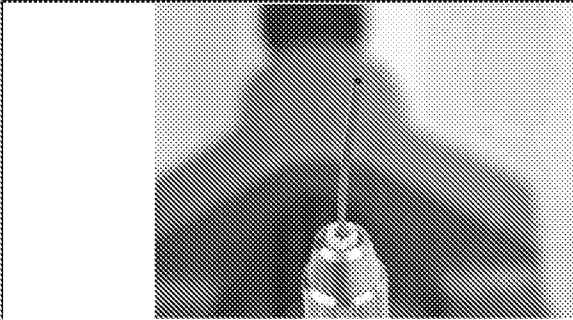
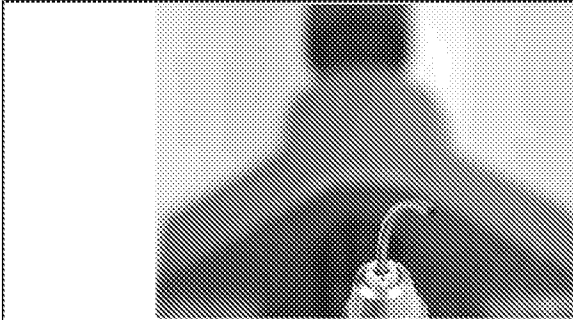
The movement which is closer to the living thing is possible.

- Lead/read terminal position

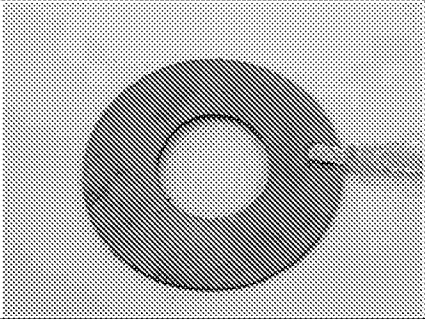
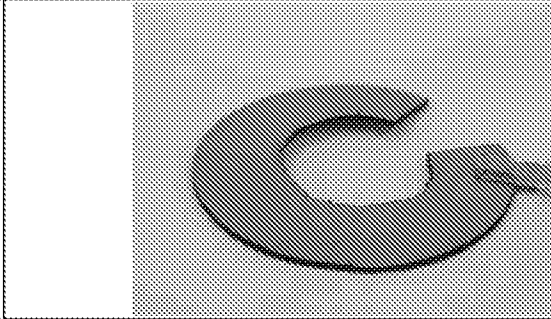
The movement is controlled by the electric resistance which responds to the distance from terminal position.

#### **4. Basic operation (in air) of actuator**

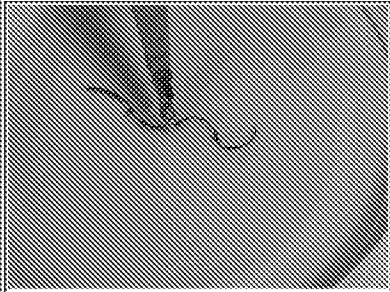
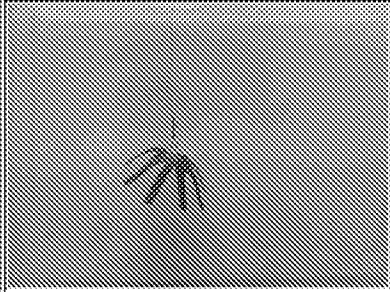
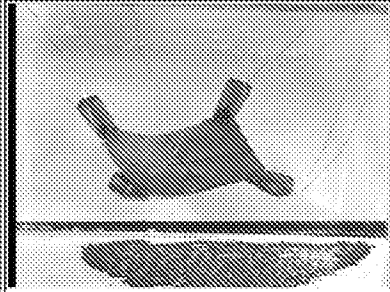
2 direction types			
<p>When the actuator element is made thick, displacement quantitative speed decreases being proportionate to thickness,, but Occurrence power being proportionate to 3 powers of thickness, becomes large.</p>			
			
0.2mm thick element	1mm thick element	3mm thick element	5mm thick element

4 direction types	
<p>Between the electrode which arranges the electrode in 4 side everything of the square pillar, (□1mm) opposes By the fact that respectively voltage is impressed the actuator point all directions unrestrictedly It is possible to make point.</p>	
	
High-speed type	Large displacement type

High occurrence power type
<p>Depending on the thing which optimizes the form operational direction of the element It can make high occurrence power show even with the thin element.</p>

	
Doughnut type	C type

### 5. Mode of life imitation motion (in underwater and air)

Animated picture	
	<p><i>Snake</i></p> <p>Reversing the polarity of four elements alternately, it is connected. As a result the movement quite like the snake is done.</p>
	<p><i>Jellyfish</i></p> <p>The element is quarried out in radial pattern, the movement like the jellyfish with the sufficient simple structure which impresses voltage on the top and bottom aspect is done. Also application as a gripper is thought.</p>
	<p><i>Surface actuator</i></p> <p>The complicated movement is possible with the insulated groove of the surface of the seat condition element and devising the pattern of voltage impression. Animated picture the left is example of the seat condition element in 3cm angle. The artificial skin for the robot, you can think the application to the diaphragm pump and the artificial heart and the like.</p>

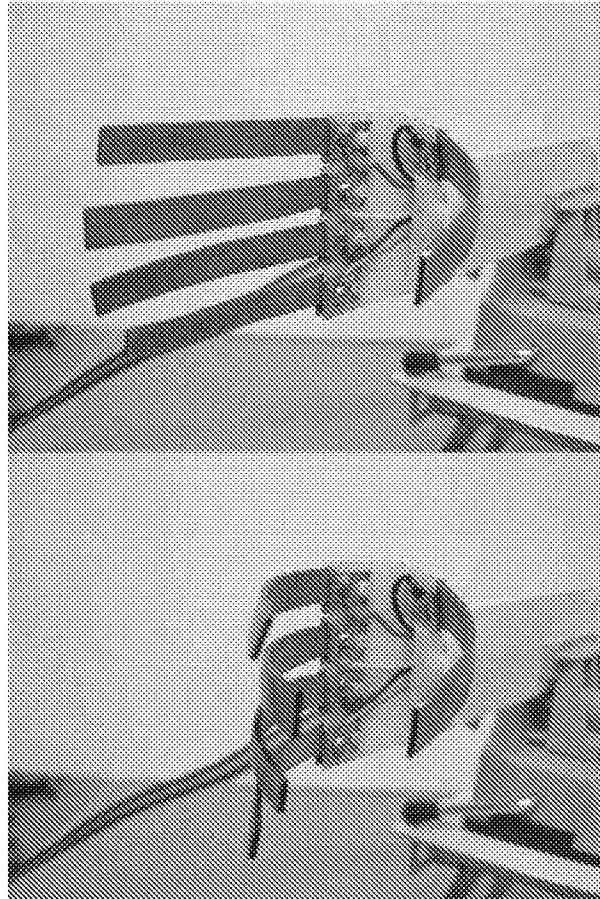


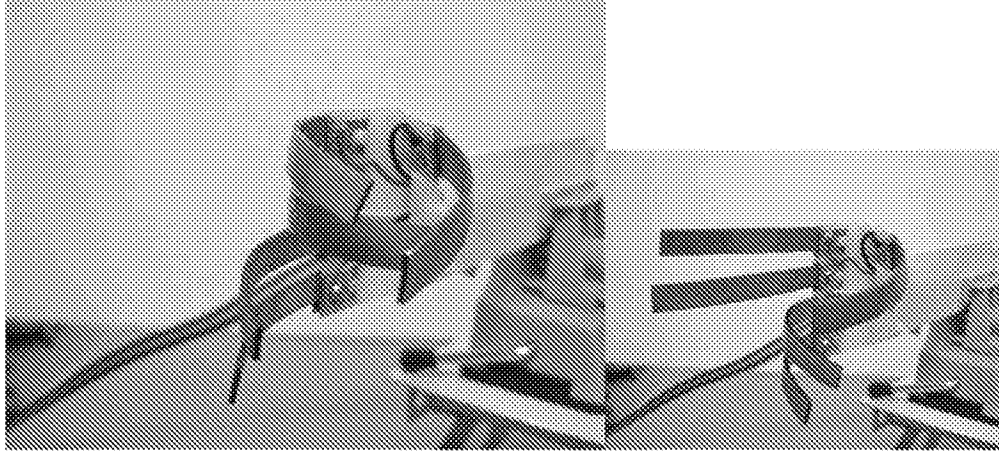
*Artificial eye*

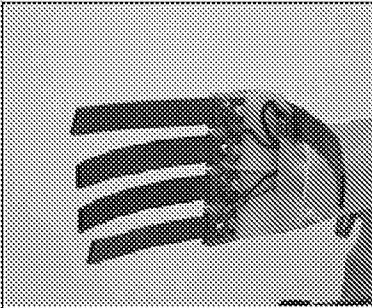
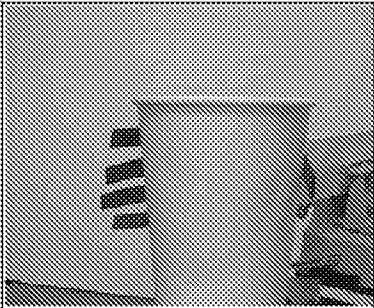

The movement whose degree of freedom like eyeball motion with the device of form is high becomes possible.

## **6. Robot hand**

It is possible to grasp the thing by the fact that each finger is moved. As for the element because it is the software in the muscle of the organism, Excessive power does not increase.





Animated picture		
		
Opening and closing operation	Object grip	Object movement

With animated picture above it is the finger which moves to only front and back 2 directions, but also production of the finger which all directions in a complicated way moves is possible.

-> To the next applied product (lens drive, microminiature cooling fan, catheter and fish robot)

\* The person who cooperation development is desired communication to [contact@eamex.co.jp](mailto:contact@eamex.co.jp). At various demonstrations and the sample, we explain details.

Windows Media Player is necessary in animated picture playback of this page.

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